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Infertility in Guernsey Cattle

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The cow (1942) is a wonderful animal. She maintains an abnormal lactation throughout twelve-thirteenths of her adult life, produces offspring during the winter which Nature fitted her to bring forth only in the spring and, herbivorous by choice, flourishes upon a diet of nuts and beans with a digestive ratio not far removed from that of sawdust. At occasional intervals her endocrine system calls a halt and she exhibits temporary infertility.

Thirty years ago, the percentage of infertility in bovines was negligible; to-day it threatens to dislocate or even destroy the dairying industry. It is significant that the breeding index of *heifers* has fallen enormously of late years, even on farms where nutritional problems do not exist and where the incidence of concurrent disease is low.

The purpose of these notes is to stress the opinion held by the writer that with the possible exception of brucella infection, herd infertility as well as the failure of individual animals to breed is in great measure based primarily upon physiological rather than upon pathological causes and that selective breeding with the object of constantly stepping-up milk production, is inducing the development of lethal factors. It is a mere question of time before the dairy cow and her fellow victim, the laying hen, become automatically extinct. By a routine adoption of our present methods of treatment we are merely temporising in maintaining a degree of fertility which may suffice for the moment. Incidentally, we are helping to fix a strain of cattle which will depend more and more upon artificial breeding aids in each succeeding generation.

The following observations are based upon many years' experience almost entirely amongst Guernsey cattle in S.W. England, where the herds are more or less self-contained or at least bear no comparison with the "commercial" herds of the more northerly counties. Whether these observations have a general application, the writer is unable to say.

It should be stated here that at least 50 per cent. of the cases dealt with showed no palpable lesions in any portion of the uterus.

The chief defects encountered have been as follows:—

(1) Failure to Develop Follicles

This condition is common in underfed heifers during autumn and winter, less so amongst cows. Of late years, however, on a large number of farms, well-grown heifers up to two-and-a-half years of age, which have grazed the year round and have been fed concentrates in addition, have failed to exhibit oestrus. Palpation of the ovaries has failed to reveal evidence of follicle development, nor has a corpus luteum been present to indicate that a heat had been overlooked. These cases respond to stilboestrol dipropionate, service being postponed until the following normal oestrus.

(2) Failure to Ovulate

Two types of abnormality have been met with. In both types the cow exhibits normal desire for service.

(*a*) The follicle is thick-walled but may be of normal size. It fails to rupture and palpation of the ovary at daily intervals will demonstrate its persistence. It regresses slowly and another follicle develops in the same or opposite ovary. There is no tendency to cyst formation. A corpus luteum does not appear in the site occupied by the follicle. The heat periods are irregular; usually there are two, irregularly spaced, during three weeks.

(*b*) The cow develops heat at the normal time and will accept service. Oestrus lasts for only a few hours and if it occurs during the night may be overlooked. Ten days later, no evidence of a fresh corpus luteum is present, indicating that ovulation has not taken place or alternatively that a corpus luteum has not followed, but a fresh follicle may be forming in either ovary or occasionally in both. Such cases appear to be fairly common. It is suspected that many of the individual cases of infertility which show no clinical abnormality are associated with failure to ovulate.

(3) Delayed Ovulation

In Guernsey cows, it has been found by the writer that ovulation normally occurs from 18 to 24 hours after the end of heat. In a considerable number of cows, ovaries have recently been palpated in which ovulation had not occurred at the 72nd hour. The walls of the follicle were thin and burst on manipulation. Spermatozoa would have to possess considerable longevity to establish pregnancy in such a case. It has been noted that cows showing this abnormality exhibit long heat periods and if one should set in at mid-day the cow will often accept service on the day following. In two instances a positive pregnancy diagnosis has followed late service.

(4) Abnormalities associated with the Corpus Luteum

(*a*) During dioestrus the corpus luteum regresses until it has become level with the surface of the ovary. At this time absorption ceases and, as has been determined by *post-mortem* examinations, a small cyst, probably no larger than a wheat grain, may form in its centre. Sometimes the fluid increases until the corpus luteum bulges beyond the surface of the ovary; more often it does not. The ovary has a firm elastic feel rather resembling that of a small rubber ball. There is no follicle present. Oestrus is usually absent though when the condition persists mild heat lasting only a few hours may occur after one or two seasons have been missed. At such times there is a discharge from the uterus of a moderate quantity of pus-like fluid, usually grey and sticky, but occasionally creamy. Such cases must not be confused with true pyometra. There is seldom a great deal of fluid present in the uterus on palpation, the "erectile" contraction of the uterus normally discernible on handling it per rectum is absent and the walls of the uterus are thickened and "doughy" to the touch. The condition appears to be a physiological hyperplasia of the uterus with oedema of the endometrium and is analogous with the so-called "false pregnancy" met with in the bitch. The corpus luteum in the Guernsey cow is normally retained for about four weeks following parturition. Occasionally it persists for several months, usually as a firmly embedded mass only slightly raised above the ovary. Digital expression is dangerous and may cause fatal haemorrhage.

(*b*) *Defects of "Timing" in the Oestrus Cycle*

The corpus luteum normally attains its maximum size in Guernsey cattle at about the twelfth day following oestrus and regresses until at pro-oestrus it has sunk almost to the level of the ovarian surface. At the twelfth day it normally comprises five-sixths and at the eighteenth about one-quarter of the total ovarian mass.

In a very large number of infertile cows examined, as well as in *post-mortem* specimens, it has been found that the ripening of the follicle has not coincided with the regression of the corpus luteum, and as opposed to all precepts, a fully developed and ripe follicle has lain, sometimes side by side, in the same ovary with a fully developed corpus luteum of the metoestral stage.

Curiously, cows thus affected show abnormal desire and a tendancy to wander off and find their own mating. Is these instances the corpus luteum apparently has charge of the field and the endometrium will not be in a condition to accept the fertilised ovum, presuming that one is present. The corpus luteum regresses in the usual way and after a few months the timing may become restored and pregnancy may follow service. These cases are common and account for many of the cows which require several services at each breeding period before becoming pregnant. It is interesting to note that the corpus luteum during the normal breeding season is orange in colour as opposed to the normal yellow of luteal tissue. The shade varies with the supply of green fodder and synchronises with the variations in the colour of the butter fat. It is deeper in adult cows than in heifers. In stall-fed cattle the colouring matter is less excepting in Channel Island breeds, when it is at all times discernible, but reaches its "ceiling value" in the spring.

(5) The Ovum

A great deal of attention has been paid to the activity and morphology of spermatozoa, but little thought seems to have been given to the viability of the ovum. In certain herds, mass infertility exists without evident cause and in spite of change of bull. Frequently starvation of pastures, through lack of attention to the soil, is at the bottom of the trouble and it seems not improbable that lack of vitamins, deficiency of inorganic salts or both combined, may exert an injurious effect upon the vitality of the ovum.

Similar mass infertility, in pre-war days, frequently followed or accompanied a diet containing an excessive proportion of maize or maize products.

General Considerations

The Bull

The raising of the bull index by the enforced use of pure-bred animals, usually derived from milk-recorded herds, tends to increase the milk yield of the offspring and so eliminates the safety factor afforded by the occasional use of a low-grade sire. Farmers of thirty years ago realised the good that could be achieved in the herd by outcrossing and that the viability of the foetus was enhanced in times of stress by such mating. The bull, being justly regarded as a dangerous animal, is usually confined and fed on a diet deficient in green fodder. He is too often relegated to the darkest corner of a dark shed and takes little or no exercise. If his semen be examined at successive matings, the motility of the spermatozoa will be found to vary enormously, so that it would be unsafe to venture an opinion as to his fertility upon the evidence of one or even two examinations.

As in other animals, his pituitary is dependent for its full activity upon the action of light, preferably ultra-violet, and its deficiency results in degeneration of his spermatic tubules and consequent infertility, often without any slackening of his desire or power of accomplishment.

The viability of the foetus depends largely upon the condition of the sperm. From its inception the foetus is a separate entity owing its vitality and powers of resistance to the following: (1) Normality of the sperm and the spermatozoa; (2) Normality of the ovum; (3) Normality of the endometrium and foetal fluids; (4) Nutrition of the mother.

Apart from the risk of separation of the foetus through infection with Bang's bacillus and possibly with trichomonas, a lethal factor may be bred into a strain of cattle with resulting tendency to abortion or to absorption of the foetus.

In the writer's practice endometritis is by no means the most common cause of infertility as it is stated to be elsewhere; in fact with the exception of cases which follow difficult parturition or retained membranes, it may be considered definitely one of the less common causes. Uterine hyperplasia of apparently physiological origin is frequently encountered. Ovarian cysts are somewhat of a rarity and nymphomania is seldom met with. Salpingitis involving one or more tubes throughout or confined to the adhesions met with in the region of the ovarian bursa, is uncommon, and when diagnosed usually proves to be tuberculous on *post-mortem* examination.

By far the majority of cases of infertility encountered by the writer have been the result of some type of ovarian dysfunction.

Treatment

Before this can be successfully attempted, accurate diagnosis is essential and can only be made in many cases after several examinations have been carried out at intervals.

Stilboestrol dipropionate has given good results where ovulation has been delayed or absent and in retention of the corpus luteum its use is preferable to and far safer than the pinching of ovaries. Fatal haemorrhage has followed expression of a corpus luteum in the writer's practice.

Hyperplasia associated with dysfunction of the corpus luteum is treated by injection of four to six ounces of 10 per cent. sugar solution into the uterine horns at the same time as intramuscular injection of stilboestrol. Three days later the animal is given an intramuscular injection of 10 c.c. pituitrin.

Good feeding and grazing, a sufficiently lengthy "dry" period, the addition of mineral mixtures and, if obtainable, fresh cod-liver oil to the diet, are useful adjuncts to treatment. A practice should be made of serving cows twice, the last time as late during oestrus as possible, and the old-fashioned practice of sending cows to the bull, unmilked, has something to recommend it.

Iodine irrigations probably do little harm. They set up sufficient irritation to stimulate the generative functions, but from results recorded by the writer it matters little whether the iodine is injected into the uterine horns or merely into the vagina. Possibly the arms of the operator may occasionally provide the necessary stimulus without the use of medicaments.

Sir Henry H. Dale, President of the Royal Society, will retire from the post of Director of the National Institute for Medical Research on September 30th. To succeed him the Medical Research Council has appointed Professor C. R. Harington, F.R.S., who is at present Professor of Chemical Pathology in the University of London and Director of the Graham Medical Research Laboratories in University College Hospital Medical School.

THE VETERINARY RECORD
June 6th, 1942

DAIRY STOCK DISEASE CONTROL AND THE WAR EFFORT

AFTER many months of discussion the Scheme for the Control of Certain Diseases of Dairy Stock is to be launched, and we feel sure it will be given wholehearted support by the great majority of the profession.

Great Britain declared war in September, 1939; the problem of food supplies at once became important and the veterinary profession was completely reserved in order to assist in maintaining and increasing the efficiency of livestock production. The crop side of agriculture has been organised and adapted to war-time needs, and there is some impatience amongst the agricultural community and indeed the profession itself at the lack of a concerted attempt to organise the animal husbandry side of agriculture and to control disease. There can be few industries or professions which have been left so long without official guidance as to their organisation for war: by contrast the Emergency Medical Service was evolved before the war and began to function as soon as war was declared. Some are of the opinion that it will have a great effect on the planning of post-war medical services.

It is recognised that certain diseases which cause great loss in our dairy herds have not been effectively dealt with in the past, either by the State or by the methods of private practice. In an attempt to remedy the situation the National Veterinary Medical Association, in co-operation with the National Farmers' Union and the Animal Health Division of the Ministry of Agriculture and Fisheries, has evolved a scheme introducing a degree of central control, which yet allows of a large amount of individual initiative and the free choice by the farmer of his practitioner. The scheme involves a type of contract practice which has been successful in the past, particularly during the heyday of the horse, but with this important difference, that the Government, through the Animal Health Division, is offering to those entering the scheme laboratory facilities and certain drugs and vaccines at a reduced price or free of charge.

History records that no important infectious disease has been controlled without concerted effort, and that nearly all attempts at disease control have met with some initial opposition from the public, and also, it must be admitted, from a section of the profession concerned. These two conditions apply to the present scheme, yet during all the discussion which has followed its publication no alternative plan has been formulated. Whatever its shortcomings the scheme may lead to a co-ordinated national health policy for farm-stock.

We were able to look back on our efforts in the last war with pride. This will be possible again if everyone determines to make the present scheme a success. The profession will then have played a vital rôle in the nation's war economy. Furthermore, it may materially assist in the post-war revitalising of European agriculture and in the foundation of an improved policy for human nutrition. These are worthy aims.

SWINE FEVER

Mr. H. German, Chairman of the Diseases of Animals Committee, reported to the Council of the N.F.U. recently that his Committee had again had to refuse an application by the Essex and Suffolk branches to re-open the question of the Union supporting a slaughter-cum-insurance scheme for swine fever.

The Union, he said, were unable to rescind their previous decision to postpone the introduction of such a scheme until the Ministry of Agriculture were prepared to recommend the use of crystal violet vaccine.

He had, however, given an assurance to the two branches that he would re-open the matter in a year's time if the Ministry failed to give the necessary assurance. He added that he had also agreed to discuss with the National Veterinary Medical Association the possibilities of special action being taken by the Association as in the case of the four principal dairy cattle diseases.

CLINICAL COMMUNICATION

Haemolytic Anaemia in a Mare due to Sulphanilamide

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[Communicating with Messrs. Pharmaceutical Specialities (May & Baker), Ltd., in connection with the case recorded below, they were kind enough to send me their comments upon it. They informed me that they considered the case to have been almost certainly one of an acute haemolytic anaemia due to sulphanilamide, and that the case is the first of its kind, to their knowledge, to be reported in a horse, or, in fact, in any domestic animal. For this reason and also since haemolytic anaemia in equines is attracting some attention in connection with phenothiazine, they urged the publication of a note of the case.]

On April 12th I delivered a mare of a dead foal. The foaling was not particularly difficult, but, as the foal had been dead for a considerable time, and there was the possibility of metritis, I decided to administer a course of sulphanilamide, in addition to local treatment of the uterus, 3 oz. being given on April 12th, 1 oz. morning and night on April 13th, and 1 oz. on the morning of the 14th, when its use was discontinued on account of the mare's condition.

On the 13th progress was quite satisfactory, the condition in the uterus having improved. When, however, I examined the mare on the morning of the 14th at 10 a.m. (1 oz. of sulphanilamide having been given at 7 a.m.), the symptoms were alarming, although the uterus was progressing very favourably. Respiration was laboured, the pulse weak, fast, irregular and intermittent, and the temperature was 102° F. All the visible mucous membranes were a dirty yellow colour, there was a trickle of reddish fluid from the nostrils, and the urine was such as occurs in azoturia. Visiting the mare later in the day I found the symptoms more marked, death occurring about 7 p.m. Unfortunately I was unable to make a *post-mortem* examination.

I have used sulphanilamide and phenothiazine on a considerable number of cases, but I should like to be assured that this idiosyncracy is an uncommon one, as such deaths are difficult to explain away to clients. If any members have had a similar experience it would be helpful, in assessing the danger attached to the use of these drugs, if they will record the facts.

NEW "SCARCE SUBSTANCES" ORDER

In conformity with Addendum V to the British Pharmacopoeia, 1932, which came into force on May 15th, the Minister for Health has now made an Order (S.R. and O. No. 709, 1942) authorising the replacement of certain spirits and tinctures by emulsions, concentrated tinctures, and liquid extracts. This Order is drawn up on similar lines to the 1941 Order which authorised the replacement of certain potassium salts by the equivalent sodium compounds.

The new Scarce Substances Order mentions four spirits, those of nitrous ether, aromatic ammonia, chloroform and peppermint, for which authorised alternatives are provided, namely: Liq. aethyl. nitrit. conc., liq. ammon. arom., emuls. chlorof. and emuls. menth. pip.; and eleven concentrated tinctures, for which formulae are given in the Fifth Addendum, in place of dilute tinctures, namely: Aurant., capsici, cardam. co., cinchon. co., gent. co., limonis, lobel. aether., opii camp., quassia, tolu, and valerian. ammon. Excepting tinct. opii camph. co., which is the present liq. opii camph. conc., all these tinctures are new, and each one is four times the strength of the B.P. tincture. Tinct. zingib. fort. will be used in the correct proportion to replace tinct. zingib. mit. and inf. calumb. conc. in suitable proportion to replace tinct. calumbae. There remain ten tinctures which are to be replaced by liquid extracts that are already in stock in the pharmacies. These are: Ext. bellad. liq. (25); ext. cinchon. liq. (5); ext. colch. liq. (10); ext. hyosc. liq. (10); ext. ipecac. liq. (20); ext. nuc. vom. liq. (12); ext. quill. liq. (20); ext. scill. liq. (10); ext. seneg. liq. (5); ext. stramon. liq. (10). The numbers in brackets express the relationship between the strength of the liquid extract compared with the strength of the tincture which it replaces. Thus liquid extract of belladonna is 25 times the strength of the tincture.—*Pharm. J.*

ABSTRACT

[THE NUTRITIONAL PHYSIOLOGY OF THE ADULT RUMINANT. Ritzman, E. G., and Benedict, F. G. (1938.) Carnegie Institution of Washington, Publication No. 494.]

The ruminant is able to convert a greater proportion of its food into flesh and milk than any other of the herbivorous animals. The wide distribution of ruminants in the wild state compared to that of the other ungulates in which fermentation occurs in the caecum indicates that their alimentary system is better equipped to deal with coarse vegetable food. The ruminant, generally speaking, grazes rapidly and then retires to re-masticate its food at leisure. This gives a two-fold advantage over animals such as the horse; in the first place, under wild conditions the ruminant remains exposed to attack while feeding for a shorter period than the horse, which chews its food thoroughly as it feeds, and in the second place, the food is more thoroughly divided by re-mastication as it has been softened in the rumen. [The fact that the stomach of the ruminant has been developed into a fermentation chamber rather than the caecum as in the horse means that fermentation precedes normal digestion instead of following it. The better utilisation of food by the ruminant probably depends more upon this factor than upon any other.—A. T. P.]

It is more economical to keep animals in the areas where their food is grown and to transport the concentrated animal products in which the calories of the foodstuffs are concentrated rather than the bulky foodstuffs themselves. The loss of calories which occurs during digestion in cattle makes the animal products more expensive to produce than the fodder; it is therefore of great importance to understand the process of digestion and metabolism in the ruminant so that waste can be reduced to a minimum.

The Physiology of Digestion, Absorption and Elimination of Waste Products by the Ruminant

The rumen is adapted to receive coarse fibrous food; the mucosa contains no glands and the sac forms a fermentation chamber in which cellulose and other carbohydrates are broken down by the numerous bacteria present. The mechanical action of the rumen and the process of rumination help to reduce the food to a fine state of division, and the authors consider that these mechanical factors provide a satisfactory explanation for the superiority of the ruminant in dealing with coarse fodder and base their conclusion upon the fact that pigs can digest as much if not more of the fibre of straw after treatment with alkali than sheep, while sheep digest a much larger proportion of the fibre of grass and untreated straw than pigs. [These facts are open to a different interpretation from that given by the authors, who accept this as adequate proof that the mechanical processes which the sheep can command allow a larger proportion of the digestible cellulose of whole straw to be exposed to bacterial attack than occurs with the pig, while when the lignin is removed by chemical treatment the pig can digest the remaining cellulose as well as the sheep. The alternative explanation is that the digestion of alkali-treated straw in both the sheep and the pig is more rapid than that of whole straw and consequently is nearly optimal, while the amount of whole straw that is digested depends upon the period in which it is subjected to fermentation; the delay in the rumen is greater than the delay in the caecum, consequently more fermentation occurs in the rumen of the sheep than in the caecum of the pig. In addition, the presence of straw in the large intestine probably stimulates peristalsis to such an extent that the delay in the caecum when whole straw is fed is less than when soft straw pulp is fed. Mangold (1937) states that the degree of division in which fibre is fed exerts little effect upon the digestibility; this suggests that lignin is not a mechanical barrier which protects cellulose from bacterial activity, but that it is in chemical combination and the effect of alkali treatment is not to dissolve the lignin and so expose the cellulose, but to break down the chemical linkage of the lignin with other constituents of the plant cell.—A. T. P.]

The capacity of the alimentary canal of the steer, sheep, horse and pig in litres is as follows:—

	Steer	*Sheep*	*Horse*	*Pig*
Stomach	182	18	16	9
Intestines	113	18	214	24

Rumination is not essential for the health of the animal and the time devoted to this process varies with the amount of roughage in the ration. Animals kept on a diet of concentrates alone cease to ruminate. At first they lose weight while the quantities of ingesta in the alimentary tract decrease; when this is stabilised a steady increase in weight occurs, Sanborn (1893), if the ration is

over maintenance standard. Cattle fed on such a diet, however, are listless. Beach (1906) found that the quantity of concentrates required to maintain a cow when no roughage was fed was small and pointed out that digestible nutrients in concentrated foods are, pound for pound, of greater value to the animal than the digestible nutrients of roughages, as less energy is expended in their digestion. The production of methane in animals fed solely on concentrates remains the same as when animals are fed hay alone and the increased food value appears to be due in addition to the decrease in energy expended in general body movements owing to their apathetic behaviour. Zuntz showed that 11·3 of the energy of hay and 2·8 per cent. of the energy of oats was expended in chewing these substances, while in the work of mastication and of digestion combined 48 per cent. of the digestible energy of hay and 19·7 of the digestible energy of oats was used.

Comparison of the results obtained from sheep, cattle, horses and the elephant shows that the ruminants can utilise a greater proportion of the crude fibre of hay than can those animals which ferment in the caecum.

The Passage of Food through the Alimentary Tract.—Light fibrous foods pass backwards to the rumen while heavy concentrates foods tend to sink into the reticulum. This observation was made by Schalk and Amadon (1928), who also found that food such as maize meal could be felt to pass directly from the reticulum through the reticulo-omasal orifice within a few minutes of ingestion. The authors state on this evidence that the ruminant possesses a "by-pass" whereby it can divert concentrates so that they pass through the alimentary tract ahead of the roughage. [This conception is misleading; there is no doubt that anything in the reticulum can pass directly to the omasum and abomasum if it is a fine enough state of division, and so a portion of the concentrates in the form of meals may take this direct route, but the contractions of the reticulum, occurring approximately once a minute, send a wave of ingesta backwards to the rumen and thus a large proportion of concentrated foods must also take this route. Foods that are in fine state of division, however, will complete the circuit of the rumen more rapidly than roughage and so tend to pass again to the reticulum and on to the abomasum at a greater speed than the roughage. Usuelli (1933) estimated the disappearance of stained oats from the rumen of cows by taking samples of ingesta by stomach tube and found that the concentration of stained particles fell by half during the first 24 hours after feeding, but particles lingered on in the rumen for eight days after feeding the test meal. Excretion of the particles in the faeces reached its peak three days after feeding the oats, but continued for 13 days.—A. T. P.]

The Weight and Character of the Ingesta.—The weight of the ingesta in the alimentary tract does not alter significantly in relation to the body weight during fasting; the relative weights of ingesta in different parts of the tract, however, do change; that of the rumen decreases while that of the large intestine increases, the former becomes more liquid while the latter becomes more solid. Many figures are quoted to show the proportion of the ingesta to the live weight and the majority vary from 10 to 15 per cent., but higher values are also recorded.

Waste Products of Digestion.—Methane and carbon dioxide are both formed during the fermentation of carbohydrate; in the ruminant most of the gas formed is eructated up the oesophagus, but according to Klein (1916) about one-third is absorbed and excreted through the lungs. The animal loses 3·97 calories for every litre of methane excreted. The gas evolved in the large gut of horses is practically all absorbed and excreted through the lungs.

The quantity of methane produced varies with the diet. Armsby and Fries (1902) estimated that 4 grammes of methane were formed from every 100 grammes of carbohydrate eaten. Measurements made by the authors during 52 metabolism experiments showed that on an average 9·6 per cent. of the total digestible energy, or 6·2 per cent. of the total ingested energy, was lost in the form of methane; the loss was lower when concentrates were fed. [These results do not agree with those previously mentioned in which it was found that cows fed hay alone produced the same amount of methane as when fed concentrates without roughage. A. T. P.] The delay in the fall of the respiratory quotient after feeding is proportional to the amount of fibre consumed, and as methane is produced largely from crude fibre there is ground for supposing that the post-absorptive condition is reached when methane poduction stops. Animals on a diet of concentrates alone cease to produce methane 48 hours after the last feed; when timothy hay alone forms the diet, methane production proceeds for four days after the last meal.

A comparative study of the methane production by ruminants and non-ruminants supports statements made previously that the ruminant can digest a greater proportion of the crude fibre than can those animals which rely upon the caecum as a fermentation chamber. More methane is produced proportionally by the ruminant than by the horse or elephant.

	Live Weight	*Total Methane*	*Methane per 100 kg. Live Wt.*
Elephant ...	3,672 kg.	470 grm.	12·8 grm.
Horse ...	675 „	106 „	15·7 „
Cow ...	610 „	200 „	32·8 „
Goat ...	46·5 „	14·7 „	31·6 „
Sheep ...	47·1 „	15·1 „	32·0 „

The Faeces.—The composition of the faeces is an index of the amount of food utilised by the animal. All herbivorous animals pass large quantities of faeces, whch is evidence of the wastage of food that occurs. The quantity of faeces passed by cattle on a diet of concentrates alone is less than when roughage is fed; this is illustrated by the following table, in which Holstein cows were fed different rations and the faeces were measured.

	Average Figures per 24 Hours			
	Feed Consumed kg.	*Water Drunk* kg.	*Faeces* kg.	*Water in Faeces* kg.
Timothy hay	9·17	26·31	16·07	81·8
Legume hay	8·83	25·67	14·97	80·8
Corn meal	4·87	11·15	2·49	73·1
Linseed meal and Bran	4·58	16·68	4·41	76·9

The quantities of faeces passed by two steers during fasting were measured. On the first day the amount passed was 15 per cent. below pre-fasting level, on the second day it was 69 per cent. below, on the third day it was 80 per cent. below and on the fourth day it was 91·5 per cent. below. The water content of the faeces remained proportionally about the same in spite of the apparently contradictory observation that the faeces became firmer in consistency. In a series of analyses it was found that the water content of the faeces remained remarkably constant regardless of the diet; it was reduced only when the diet consisted of concentrates without roughage. Of all constituents the greatest variation on different diets was found in the crude fibre and ash of the faeces.

Factors Effecting the Digestion and Absorption of Food

Drinking Water.—Water softens food and dissolves the soluble constituents and serves as a medium for transporting the food to the tissues; it removes waste products from the body and helps to control the temperature of the tissues. The water intake is determined by the water lost from the body as a result of the activity of the animal. Hibernating animals lose little water as they have a low rate of metabolism and consequently the excretions are extremely small, the small demands for water are met by the water produced as a result of oxidations of tissue in the body.

Water is drunk by cattle in large quantities and passes to the rumen, where, together with the saliva, it provides the necessary medium in which fermentation can proceed rapidly. The loss of water in the faeces is fairly constant and in lactating cows was found to reach as high as 24·5 kg. daily under normal conditions, while the water excreted in the urine was in the region of 8·6 kg.

Ratio of Water Intake to Dry Matter in the Feed.—The amount of water consumed is closely related to the amount of dry matter in the feed; on a sub-maintenance, maintenance and fattening diet the variation found in twelve steers was from 2·3 to 2·8 kg. of water to every kg. dry matter in the food. The volume of faeces measured over a long period was closely related to the water and dry matter ingested, but the volume of urine excreted over the same period was fairly constant regardless of the quantity of feed consumed. In one animal, however, when fed on a fattening diet rich in protein, the volume of urine excreted was nearly doubled.

The influence of lactation on the amount of water consumed is affected by the feed and temperature. Ewing (1914) demonstrated that the environmental temperature affected the amount of water consumed in a steer, and so, besides considering the ratio of the amount of water and dry matter ingested, the temperature must also be taken into account before any conclusion regarding lactation can be drawn. Ewing fed a steer on silage alone during the winter months and early spring and found that the animal drank no water for over fifty days; when the weather became warmer the animal began to drink water and by degrees it was drinking as much as animals fed on silage with other feeds. Moore and Bowling (1930) found that ten lactating cows which they observed from March to December, while they were producing on an average 20 kg. of milk daily, drank about 64 kg. water a day, giving an average of 3·2 kg. for every kg. of milk.

Results obtained by others are as follows:—

	Kg. water per kg. milk	*Season and feed*
Cannon *et al.* (1932)	3·5	Winter, animals out of doors.
Fuller (1928)	4·4	January, indoors.
Armsby and Caldwell (1888)	2·3	Fed fresh grass.
	4·2	Fed dry grass.
Ritzman and Benedict (1938)	3·31 to 3·78	Fed hay, grain and silage.
	4·5 to 5·05	Fed hay alone.

Elimination of Water.—About 50 per cent. of the water excreted is lost in the faeces; the amount excreted in the urine is variable while the loss as vaporised water is approximately proportional to the heat production. If an animal drinks excess water the increased excretion takes place through the kidneys, the water content of the faeces and the loss as vaporised water is not altered. It has been stated that of the total water lost by the cow, 55 per cent. is excreted in the faeces, 14 per cent. in the urine, 16 per cent. as insensible perspiration and 15 per cent. in the milk.

Waste Products of Metabolism during Feeding and Fasting

Urine.—The volume of urine varies with the quantity and character of the food; more is excreted on a high protein diet than a low protein diet, but the actual quantity of food has little influence. Environment affects the quantity of urine excreted, which is greater in cold than in hot weather; a sudden increase in the excretion of urine coincides with a drop in temperature, but the animal also drinks less, and so the quantity excreted returns to the previous level.

The percentage of solid matter in the urine is not uniform; in two steers it was found that the proportion of nitrogen in the urine was low on a sub-maintenance ration, but higher on a fattening ration.

Urinary Nitrogen during Fasting.—Carpenter (1927) found that the hourly excretion of nitrogen in the urine of fasting steers depended upon the preceding feed rather than on the body weight. The maximum value was 0·075 grammes per kg. body weight or 38 grammes per 500 kg. in 24 hours. In non-lactating Holstein cows the authors found the excretion of nitrogen in the urine after four or five days' fast to vary between 28 to 60 grammes per 500 kg. body weight per 24 hours. The average figure for Holstein cows was 40 grammes per 500 kg. body weight per 24 hours and for Jersey cows 47 grammes per 500 kg. body weight per 24 hours. When the preceding feed was linseed meal and bran the nitrogen output was higher than when the diet had been hay or corn.

Composition of Urinary Solids.—Carpenter partitioned the solid matter of the urine and found that hippuric acid and amino acid nitrogen formed 50 per cent. of the total nitrogen when the animals were regularly fed. The proportion of these substances dropped to 2 per cent. during fasting, their place being taken by urea and ammonia. He considers that the fasting base line as indicated by the constancy of the chlorides, phenols, fixed bases, organic acids and nitrogen is reached in four to six days; in addition the urine becomes acid in the same period. The basal requirements for protein appear to be small.

Nitrogen Balance.—Figures for nitrogen balance give peculiar results. Møllgaard (1931) found that steers kept on a sub-maintenance ration were in negative nitrogen balance; on maintenance ration 25 per cent. or more of the nitrogen of the ration was stored, but increasing the feed over this level eventually produced a fall in the amount of nitrogen stored. The maintenance requirement of nitrogen was in the region of 30 grammes a day and his results are given below.

	Nitrogen Digestible grammes	*Nitrogen Urinary grammes*	*Balance Nitrogen grammes*
Sub-maintenance ...	18	28	—10
Maintenance	36	33	3
Super-maintenance ...	270	202	68
" ...	353	285	68
" ...	328	308	20

During the last period of excess supermaintenance feeding the amount of nitrogen stored dropped, but the amount oxidised for energy increased, indicating that the animals had reached a physiological limit in the use of protein structurally.

The authors obtained similar results and in addition observed that both dry and lactating cows appeared to have little capacity for the storage of protein, but lactating cows were able to utilise a greater proportion as nitrogen is used in the production of milk.

These data support Møllgaard's theory that the physiological condition of the animal is an important factor in determining the amount of nitrogen utilised.

Energy of Urine.—The nitrogen excreted in the urine may serve as an index of the energy of the total solids in man, and the energy lost in the urine is an important factor to be considered when determining the energy balance of the body. The nitrogen of the urine is not a reliable index of the total solids in herbivores, as a relatively large and variable amount of non-nitrogenous products of vegetable origin are present. It was assumed until recently that the urine of cattle contained 14 calories per gramme of nitrogen; this figure was obtained by taking the average of values given in the literature. Measurements of the calorific value of the solids of the urine of the cow in the bomb calorimeter, however, showed wide variation and figures ranging from 40 to less than ten calories per gramme nitrogen were obtained. Consequently in any experiments involving the energy balance in herbivorous animals the energy of the urine should be directly measured in a bomb calorimeter.

Insensible Perspiration.—Water and carbon dioxide are lost as insensible perspiration through the skin and this loss must be taken into account in metabolism experiments. The insensible loss is closely associated with metabolism; the total weight of carbon dioxide lost through the lungs and skin is not derived entirely from body tissue, the oxygen comes from the air and only the carbon represents loss in body weight. The large and variable amount of water vapourised from the lungs and skin also has a bearing on metabolism, as it represents a method of losing heat; each gramme of water that is vapourised requires 0·574 calories at 40° C. A large part of it is taken into the body as water, but the water formed in the process of oxidation, particularly of fat, receives its oxygen from the air.

Two methods are used to measure the insensible loss. The first is to measure directly the intake of oxygen and the output of carbon dioxide and vapourised water; this method gives precise results but requires elaborate apparatus. The second method is simple in theory and consists of weighing the subject on a sensitive balance. This process, however, is not at all simple with large animals; the food eaten and the weight of the excretions must be accurately determined and the construction of a balance large enough to weigh cattle accurately is not easy. The balance constructed by the authors for this purpose is accurate to a quarter of a pound.

Daily Variations.—Insensible perspiration is reasonably uniform throughout 24 hours and from day to day, although large variations occur in the other factors weighed, the faeces, etc. The highest daily loss was found to be 13·2 and the lowest 9·6 kg. Faeces and water were weighed to the nearest 10 grammes and the animal to the nearest 225 grammes. The error in these measurements is estimated not to exceed 7,000 grammes for any single day.

Nutritive Level and Insensible Perspiration.—The gross heat production is in general proportional to the nutritional plane and an increase in heat production is accompanied not only by an increase in the output of carbon dioxide, but also by a greater loss of heat by vaporisation of water. This was demonstrated on two steers which were kept in a stall at constant temperature and deprived of exercise.

Level of Nutrition	*Metabolisable Energy Calories*		*Insensible Perspiration grammes*	
	Steer A	*Steer B*	*Steer A*	*Steer B*
Under-nutrition	8,100	7,900	4,020	3,640
Maintenance	14,600	13,600	10,160	9,920
Fattening	33,800	34,400	20,250	21,010

Trials performed on Holstein and Jersey cows showed that the insensible loss was greater in the larger Holstein animals. The ratio of insensible loss to metabolism, if taken for groups of cows of the same strain, is similar regardless of the character of the feed; individual variations, however, are so wide as to make it impossible to calculate the metabolisable energy from the individual measurements of insensible perspiration.

Environmental Temperature and Insensible Perspiration.—A fall in temperature decreases the insensible loss. This was demonstrated on a cow kept in the laboratory at an accurately controlled temperature. Less water was drunk at a low temperature than at a higher temperature, and an average decrease of 200 grammes in the insensible perspiration and of 204 grammes in the water intake incurred for each fall of one degree centigrade below 17·7° C. Increases in temperature over 17·7° C., however, produced much larger increases in insensible loss.

During a 14-day fast the loss in insensible perspiration rapidly declined, falling from the region of 15·5 kg. to reach a steady level of 3·6 kg. by the fifth day of fast.

Proportion of Water Vapour in Insensible Perspiration.—Carbon dioxide contains 27 per cent. carbon; by multiplying the value of carbon dioxide by 0·27 and deducting the result from the total insensible loss the amount of water vapour can be found.

Of the total insensible loss from a cow on maintenance ration 87 per cent. was due to water vapour; in fasting animals the figure was lower—84 per cent. Both the level of nutrition and the environmental temperature affect the relative proportions of water and carbon dioxide in the insensible perspiration.

The difference in the production of carbon dioxide by cows at different levels of nutrition when considered as a respiratory quotient gives some indication of the amount of fat being used besides indicating the energy demands of the body. During fasting the carbon dioxide output drops: in steers it fell from 140 grammes a day to the region of 55 grammes a day by the fourth day of fast; by determining the respiratory quotient it was estimated that the steer consumed from 650 to 880 grammes of body fat at the fourth and on subsequent days of fast.

Assuming that 1 gramme of water of vaporisation uses 0·574 calories it was calculated that the percentage of heat lost by water was from 17 to 34 per cent. of the total heat production in non-lactating cows.

The Effect of Food and the State of Nutrition on Physiological Functions.—The heart rate varies considerably with the plane of nutrition in steers; it was found to average 33 beats per minute when the animals were fed below maintenance level, 44 beats per minute at maintenance level and 78 beats per minute with super-maintenance feeding. Fasting for 10 to 14 days reduced the heart rate to 28 to 30 beats per minute. Fuller (1928) found that lactating cows maintained a quicker heart beat than dry cows.

(*To be continued.*)

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QUESTIONS IN PARLIAMENT

Milk Production: Scotland

Mr. Snadden asked the Secretary of State for Scotland whether, in view of the urgent need to increase the production of milk in Scotland, he will consider modifying for the period of the war existing regulations governing the standard of buildings required for milk production?

The Secretary of State for Scotland (Mr. T. Johnston): In view of the importance to the public health of clean and safe milk, I am not prepared to approve a general relaxation of the dairy by-laws. If, however, my hon. Friend knows of any instance where the administration of the by-laws is preventing an increase of production for the liquid milk market and will send me particulars, I will consider whether any action can properly be taken.

Mr. Snadden: Has my right hon. Friend received any representations from the Scottish Marketing Board on this subject, and does he not think that, if these regulations were relaxed, the large number of farmers with small numbers of cows would be able to help the Scottish milk position?

Mr. Johnston: I suggest that my hon. Friend should study my Answer. If he can give me particulars of any case where the by-laws are being improperly administered, I will very carefully consider it.

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Milk Inspection

Sir Percy Hurd inquired whether the Minister of Health was aware of the waste of petrol, and official time and money, involved in the duplication of milk inspection by county councils and rural district councils because graded milk was under one authority and ordinary milk under another; and what remedial measures he proposed to take.

Mr. Ernest Brown (Minister of Health): It is open to councils to arrange among themselves in order to avoid any duplication of inspection, so far as that may be consistent with duly carrying out their responsibilities. I will make inquiries with regard to the particular case about which the Hon. Member has communicated with me.

Sir Percy Hurd: Does not the Minister agree that it is desirable that there should be co-ordination and not this waste?

Mr. Brown: I do not know about co-ordination, but undoubtedly it is desirable that the authorities concerned should work together.

* * * * *

Dr. T. J. Jenkin, who in 1914 was appointed the first agricultural organiser for Brecon and Radnor, succeeds Sir George Stapledon as Director of the Welsh Plant Breeding Station and Professor of Agricultural Botany at the University College of Wales, Aberystwyth. In 1915 he was appointed adviser in agricultural botany for North Wales under the University of College of North Wales, Bangor, and in 1919 became adviser in agricultural botany for the Aberystwyth College area. For a period he was seconded to the Ministry of Agriculture for the purposes of the Grassland Improvement Campaign, and during this time was appointed Senior Research Officer at the Welsh Plant Breeding Station.

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

June 9th.—D.V.S.M. Oral and Practical Examinations begin.
June 10th.—Meeting of the Scottish Metropolitan Division, N.V.M.A., at Dundee, 2 p.m.
June 19th.—Meeting of the North Wales Division, N.V.M.A., at Llandudno, 2 p.m.
June 25th.—R.C.V.S. Written Examinations begin.
June 29th.—R.C.V.S. Oral and Practical Examinations begin.

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Association Correspondence

All correspondence for the General Secretary, N.V.M.A., also for the Editorial Representative, should now be addressed to No. 36, Gordon Square, London, W.C.1.

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UNIVERSITY OF LIVERPOOL VETERINARY FIELD STATION

The Field Station of the Liverpool University School of Veterinary Science at "Leahurst," Neston, Wirral, was inaugurated by a luncheon on Thursday, May 28th, 1942. The chair was occupied by the Chancellor of the University (Lord Derby) and he was supported by the Pro-chancellors and the Vice-chancellor. Amongst those present were Mr. John Holroyd, President of the Royal College of Veterinary Surgeons, Major A. Douglas, of the Ministry of Agriculture, Professors J. F. Craig and J. G. Wright, with members of the teaching staff of the veterinary school.

The station comprises a hospital for farm animals, an animal husbandry unit, together with teaching and laboratory accommodation, and a hostel for students. Messrs. J. Bibby and Sons, of Liverpool, have placed at the disposal of the school for teaching purposes their two large dairy farms which are situated close to the field station. At present final year students are in residence and third year students make visits for instruction in animal husbandry.

Professor J. G. Wright, who directs the station, stated that although the venture had just commenced the support they had received from neighbouring veterinary surgeons was most gratifying, and already a good variety of clinical material had been received at the hospital.

After luncheon the visitors inspected the hospital, the animal husbandry unit (the buildings of which are in the course of erection), the paddocks and botanical specimen garden and the animals of the animal husbandry department.

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R.C.V.S. ANIMAL MANAGEMENT EXAMINATION

List of Successful Candidates

(*Continued from page* 219)

Dublin:

Bourke, J. P.
Cooney, John
Cooper, R. T.
Cosgrove, J. F. (credit)
de Lacey, T. (credit)
Donnelly, J. G.
Erskine, R. G.
Feeney, G. H.
Fiddis, W. A.
Flanagan, M.
McGuinness, T. P. H. (credit)
McHale, C. J.
Molloy, P. F.
Moloney, E.
Moorhead, P. J.
Murphy, L.
O'Dee, M. J.
Richardson, J. P.
Sweeney, P. J.
Walsh, R. A. H.

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THE NATIONAL DEMAND FOR MILK

"Our war-time consumption of milk has vastly increased," says *The Farmers' Weekly* in its issue of last week, and continues: "As Professor H. D. Kay said recently, we can even now give a fairly close estimate of the country's future needs of milk. To bring consumption up to the amount needed for adequate nutrition, we must produce 1,650 million gallons a year—a 75 per cent. increase in winter and 30 per cent. in summer production. That is a target figure if you like. It implies a vast extension of our production, and coupled with the policy of seeing that that milk is available to the consumer in the amount he needs for nutrition, there will be a big market. Our post-war milk production must be based on the fertility of our own soil, on home-grown foods. . . . In this huge and ever-growing national demand for milk, in this timely recognition of its supreme nutritional importance, we can begin to see taking shape the vision of peace-time farming prosperity, and fertile land. There can be no vigour in the nation if there is no vitality in the land."

ROYAL ARMY VETERINARY CORPS

The following announcements are made in recent issues of *The London Gazette*: Denys Clement Edward Danby (230998) to be Lt., March 30th, 1942; John Basil Edwards (225653) to be Lt., February 24th, 1942; to be Lts.: Claude David Hopkins (231465), James Carl Newhook (231262), April 16th, 1942; John Albert Bunker, B.Sc. (231531), April 23rd, 1942.

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FARM NEAREST THE ENEMY: AWARDS FOR BRAVERY

For carrying on their farm work without a break under fire from the long-range guns on the coast of France and attacks from the air, the occupant of the nearest farm to the continent, Mr. Gilbert Mitchell, has been awarded the George Cross, and his wife and their assistant, Miss Grace Harrison, the British Empire Medal "for brave conduct in civil defence." Following are the terms of *The London Gazette* announcement:—

"Mr. and Mrs. Mitchell and Miss Harrison have made an unexampled effort and shown sustained bravery and devotion to duty in carrying on farming under the gunfire and air attacks of the enemy. The farm is at the nearest point to the Continent and is scarred with filled-in shell-holes. The farm buildings are probably the most vulnerable in the country, yet work was carried on throughout the Battle of Britain and ever since. During intense air raids the German pilots machine-gunned the farm, and work on the land had to be stopped, but in spite of all the difficulties and dangers there was no change in the routine of milking and attending to the stock. When cutting corn Mr. Mitchell and Miss Harrison often had to take cover under the tractor or binder when German pilots were machine-gunning. On one occasion, when Mr. Mitchell was driving the tractor, a balloon nearby was shot down in flames. The burning fabric fell across the tractor, but was quickly extinguished by Mr. Mitchell, who then carried on with his work. Mr. and Mrs. Mitchell, with the help of Miss Harrison, remained at the farm and not only saved their own crops, but also those of other farms which had been evacuated."

"At first the shell firing affected the cattle's nerves and some cows dropped their milk," said Mr. Mitchell when interviewed. "The horses were affected most by the machine-gunning, but after a time they, like us, got used to it."

* * * * *

GUIDE TO WAR GASES

"War Gases: Their Nature, Effects and Treatment," is the title of a new penny folder issued by the Ministry of Home Security, and obtainable from the Stationery Office of through any bookseller.

The folder, which is designed as a pocket chart for easy reference, sets out in tabulated form descriptions of the various war gases, the characteristic smells by which they can be recognised, and the effects of each gas upon the human body. There are simple instructions for first aid treatment.

The chart is intended for the instruction of the general public, as well as for official use by members of the civil defence services.

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THE COMMERCIAL HORSE

An Economical and National Necessity

Under the above headings the National Horse Association of Great Britain (35, Wymond Street, Putney, London, S.W.15) have issued a leaflet which is timely in view of the fact that the steadily increasing drain upon our supplies of petrol and oil, the growing shortage of labour, and the lack of skilled labour for motor repairs, are bringing about a very difficult situation for the users of commercial transport, and in order to overcome their difficulties, the horse is being used more than it has been for at least a quarter of a century. The leaflet points out that practically everything in connection with horse transport can be provided in this country—food, harness and vehicles, and that a proper and full use of the horse is a valuable contribution to the war effort of the country for it means the lessening of the strain upon our overseas transport.

Long distance road transport and very heavy haulage are still being left to mechanical vehicles, but short distance transport, such as the delivery of goods—a class of work involving a large number of stoppages—is still undoubtedly the province of the horse, and in most cities there is a preponderance of short journeys. The most profitable employment of horses in commerce, states the leaflet, lies within a haulage radius of five to seven miles. Some London firms operate in an eight-mile radius, the horses covering 20 miles a day, but many tradesmen, retail firms and municipal departments work within a radius of three or four miles.

In narrow streets and in confined spaces, the horse-drawn vehicle has the advantage that it can be turned round more quickly and with less disturbance than most motor vehicles which have a far larger turning radius. Further it has to be remembered that the waste products of the stable supply valuable manure for the land, which is a matter of great importance in these days, when maximum food production in this country is vital. The horse is also required to-day more than ever on the farms, for although the number of farm tractors in use has doubled since the outbreak of the war, they cannot do all the work. There is plenty work on the farms for all the tractors and all the horses available and the demand for horses for ploughing and for all the other work of cultivation, has not been so keen since the end of the last war. The horses can be used for work in fields which are too small or too stony or too irregular in shape for the economical use of the tractor.

With regard to the initial charges of horse transport, the leaflet puts the average cost of a heavy draught commercial horse at from £65 to £85, and a waggon from £100 to £150. The cost of the waggon may be correct; but judging from the reports of some of the recent sales in Scotland, a commercial draught horse which can be bought for £60 to £80 will not be a really first-class animal, for within the past three months we have seen many good Clydesdale geldings of four to seven years old changing hands at prices from £100 to £120, and even up to £150 and £200 and over. The average cost of a suitable van horse is put at £55 to £70 and a van at £75 to £90.

The average life of a van or waggon is stated to vary from 15 to 30 years. This, of course, will depend on the amount and nature of the work it has been called upon to perform, but given reasonable care and attention, it may last even more than 30 years. The average service life of a commercial horse is approximately seven years, though many of them last longer, and even when a horse is finished with town work, he may often make quite a good price to go back to the farm for a few more years of useful work. There have been many cases of Clydesdale geldings working for ten years or more in the streets of Glasgow.

According to the leaflet, the total depreciation on a horse and van does not exceed £20 a year; and it is further stated that for the capital cost of a motor vehicle, four or five first-class horses can be put on the road, covering as many different areas at the same time, whereas the motor is confined to one area. Where motor transport is concerned, insurance and depreciation are a very heavy item, and motor transport vehicles are often lying idle through the difficulty of obtaining spare parts—a difficulty which does not arise to the same extent with the horse-drawn vehicle.

From a London firm which used both horse and motor transport the National Horse Association has obtained an interesting statement showing the comparative costs of horse-drawn and motor vehicles. The cost of a light horse van, averaging about 100 miles per week, works out at £2 8s. 10d. weekly or 5·86d. per mile, while a 10-cwt. motor van averaging 120 miles gives a weekly cost of £2 13s. or 7·3d. per mile. It is noted that in this connection the cost of the feeding and maintenance of a horse is definitely estimated on the high side because, owing to the lack of competent horsemen, there is more waste than would occur in a normal time. There is very little difference in the wages paid to horse and motor drivers. There is no doubt that at the present time the horse has a very impotant place to fill both on the farm and in the realm of road transport.

* * * * *

An outbreak of foot-and-mouth disease was confirmed on Thursday of last week among cattle at Wanborough, Swindon. Two outbreaks were confirmed in the Gloucester area on Friday of last week, and Gloucester Market, the only market directly affected, has been closed. One of the outbreaks occurred among cattle and the other among pigs.

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Weekly Wisdom

"*. . . because not everything was done, Mr. Flosky deduced that nothing was done, and from this deduction, according to his system of logic, he drew the conclusion that worse than nothing was done.*"—From Thomas Love Peacock's *Nightmare Abbey*. (Survey Committee please note!)

Veterinary Impression No. 2

The Injection F. H.

SCIENCE AND GOVERNMENT

The following address on a subject of outstanding importance and interest to all concerned with the future well-being of science was given by Lord Samuel at a recent meeting of the Parliamentary and Scientific Committee, of which he is President.

There has been much discussion of late on the relations between science and politics. Ought the scientist to detach himself, so far as he can, from public affairs? In order to preserve his intellectual independence, to safeguard his single-minded search for truth, ought he to absorb himself entirely in his own vocation, leaving others to interest themselves in matters political? Or, on the contrary, should he say: "These times are recognised to be the age of science; no one, therefore, can be so well qualified to guide its activities as the scientists; it is for us to define ends and devise means; in public affairs ours should be the dominant voice"?

There are some again who think that his course should be neither the one nor the other. Surveying with philosophic eye "the age of science," taking stock of the present state, material and moral, of the world, they hold that it is bad. Art and handicraft killed by mechanism, the artisan turned into a machine-minder; tranquillity destroyed by hurry and speed; religion undermined by materialism; vast wars extended over all the continents and oceans, into the skies and the depths of the seas, with horrors worse than ever known by man in all the long course of his blood-stained history—if these be the gifts of science to the world, then, they say, science stands condemned. The right conclusion should be that, far from being granted a dominant voice, the scientist should rather be relegated to a shamefaced obscurity; there to find refuge and remorse and to seek some better avocation!

Let us examine these three propositions; and let us take the last first; for if that be accepted we need trouble no more about the others.

Need it be accepted? Imagine that, by some moral upheaval and economic revolution, modern science were annulled and discarded; and that, like the people in Samuel Butler's "Erewhon," we went back to an age when there was no mechanism, no electricity, no applied physics or chemistry, no science at all. But then we should find ourselves back also in an age when the achievements of modern medicine, preventive and curative, and modern surgery, were unknown; we should have let loose again plague, cholera, malaria, a score of diseases now under control; lives would be cut short, and a tragic infant mortality again prevail. The cultivation of the land would revert to the primitive; without easy transport of food-stuffs, as of other commodities, privation and famine would again be the common lot of the greater part of mankind. The printed book would disappear, and with it the system of universal education that it has made possible. The pleasures of travel, and most of the comforts and amenities to which we are accustomed would be lost. Millions of men would again be doomed to heavy brute labour, from which the machine has redeemed them. Cast away science and half civilisation would be lost.

If mass-production imposes on the worker monotonous labour, let hours be shorter—as applied science might easily make possible—and let change of work become a normal part of industrial organisation. If spiritual and intellectual values are crowded out by economic pursuits and material anxieties, let them be rescued, consciously and of set purpose, and restored to honour. If our towns are mean and our countryside is vulgarised, let law and private action combine to redeem our environment. These evils are not necessary features of a science-minded society. On the contrary, they are an offence against it. The cure may be found, not in less science, but in more.

As to the perversion of discoveries to purposes of aggressive war, that is not the responsibility of the scientist, or the technician. We do not blame Gutenberg or Caxton because much pernicious literature has come from the printing-press; or the pioneers of chemistry, because there are poisons and poisoners; or the farming community because they provide nutriment for criminals and wastrels among the rest. It is the mission of scientists to initiate and develop means to promote the material welfare of mankind; and if wicked rulers, encouraged by non-moral philosophers, use their inventions for abominable ends, scientists are not to be condemned for that. Were it feasible for a world-wide league of men of science to be created and to exercise an effective veto on the use of all mechanical and chemical discoveries for purposes of war, it would no doubt be an excellent thing. But that is not within the bounds of possibility. And certain it is that if scrupulous men of science were to withhold their co-operation in the peace-loving countries, when war is waged against them by aggressive nations whose scientists have no such scruples, then the results would be the precise opposite of what was desired and intended. If Germany produces magnetic mines, Britain must evolve the antidote. If Germany makes powerful battleships and deadly submarines, and immense numbers of guns, tanks and planes, Britain must make the same things, and more of them and better. If each of our scientists were to say, "This is not what I set out to do in life; this is no business for me to take a hand in," the consequence could only be a swift victory for the militarist Powers, and with it the enthronement of their philosophy in unchallengeable control of human affairs. The uncompromising pacifist, however little he may intend it, is the accomplice of the aggressor.

Refusing, then, to regard the scientist as a dangerous malefactor, with whom Government should have as few relations as possible, we turn to consider what the relations should be.

The fact must be faced in the first instance that the new movements active in the world have brought science very definitely into politics. The Nazi creed, strangely enough, makes claim to a scientific foundation. It purports to possess, in the writings of Houston Stewart Chamberlain, Oswald Spengler, Rosenberg and others a factual basis. Selected history and a superficial ethnology furnish a foundation, pretentious but flimsy, for the creed of Blood and Soil, and for the consecration of violence. Quisling professors prostitute their minds to spread the doctrine. It is indispensable that answers should be given. The case must not be allowed to go by default. Only men of science can reply effectively. There is a plain duty there.

Further, the totalitarian system, in any of its forms—National-Socialist, Fascist or Communist—asserts, as its very essence, the right to control the mind. There is to be conscription, not only of soldiers, workers and wealth, but also of thought. Power is not to be the servant of Ideas; Ideas are to be the servant of Power.

The Sidney Webbs, in their book on *Soviet Communism*, point out the extremes to which the control of political theory over scientific investigation has sometimes been carried in Russia. They quote *The Journal for Marxist-Leninist Natural Science* as declaring these principles: "We stand for Party in mathematics"; "We stand for the purity of the Marxist-Leninist theory in surgery." They mention, among other examples, that addresses had been delivered to a society of Marxist technicians on "The Dialectics of a Synchronising Machine," and "The Dialectics of Graded Steel."

Men of science, like men of religion, cannot accept such servitude. Impartiality is a great quality, no doubt; but not the impartiality of a certain Mayor, who is said, in an eloquent address on his inauguration, to have promised that, during his mayoralty, he would maintain "an attitude of strict impartiality between Right on the one hand and Wrong on the other." Where there is a clear-cut issue between intellectual independence and subservience, scientists as such, and all organisations of scientists, have the duty to speak out. And if this means taking sides in controversial politics, they are bound to choose their side and take it. The Charter of Principles, adopted by the Council of the British Association, and endorsed by the International Conference on Science and World Order held under its auspices in London last September, is a striking example of such a declaration.

Nor is the scientist less a citizen than other men. A democracy depends for its success on the sound judgment of its electorate. If any group of men of intelligence and integrity refuse to participate in the ordinary duties of electors or legislators, the nation is to that extent weakened in one of its most vital functions. You will remember that Sir Isaac Newton took an active share in guiding the country through the troubles of the time of James II; and as Member of Parliament for Cambridge University promoted the settlement after the Revolution of 1688. The Newton of our own day, Einstein, for all his love of isolation and concentration on his own work, constantly, by voice and pen, declares what he has himself called his "passionate interest in social justice and social responsibility."

Inevitably, fame won in one sphere lends influence in another. Not always justifiably. Novelists and film-stars may contribute if they wish to symposiums on "What I Believe," or the like; or an Atlantic flyer give judgment on the basic problems of ethics and statesmanship. We may hear what they have to say with curiosity, but it is not incumbent on us to accept it as authoritative. And a physicist who wins distinction by discovering some hitherto unknown effect in nature is not to be accepted on that account as a sound guide on communism or on currency. The important thing is that a scientific education creates a special habit of mind—a love of accuracy, of definiteness; a desire to trace effects to their causes, and to treat the causes when you wish to modify the effects; above all a reverence for truth and a respect for fact as such—and that these qualities are of high value in politics as well as essential in science. Those who are trained in the one have special qualifications, therefore, for giving guidance in the other.

They are qualities needed also in the general body of citizens. This is one reason among others why Huxley rendered such great service, sixty and seventy years ago, in persuading the nation to introduce science as a subject of general education—not to predominate, but as one province.

The fact is that, so long as culture is not narrowed, the more the nation as a whole becomes science-minded the more likely it is to prosper. The competent men who write books of popular science for the multitude—sometimes looked down upon by the pure scientist—do render a valuable service; and the vast circulation enjoyed by their writings cannot fail to influence greatly the national outlook.

In common usage the term "scientist" has meant particularly a worker in natural science—physics or chemistry, or whatever it may be. Properly it also includes, of course, those engaged in the social sciences—politics, economics, statistics—sociology in all its branches. In politics, however, there is so large a measure of philosophy, and also of art—using the word in no invidious sense—that for my own part I have always had some doubt whether there is such a thing as political science at all. But I suppose there must be since there are professors at the universities who teach it. However that may be, the more the social problems are approached in a systematic, scientific spirit the better. The British Association, recognising this, has lately established its special Division for the study and advancement of the social sciences.

Only when the nation generally becomes science-minded will its Parliament and Government be so. In spite of the changes during the last two generations, that is as yet far from being the case. The effects of the system of education that was inherited from the Renaissance, almost monopolised in its higher branches by literature and the classics, still greatly influence the classes from which are drawn most of our Ministers, Legislators and Civil Servants. None of our Prime Ministers, with three exceptions—Lord Salisbury, Mr. Balfour and Mr. Ramsay MacDonald—have taken any special interest in scientific matters. Balfour, and Haldane also, in positions of great authority, forged fresh links between science and Government. The establishment, in which they took a leading part, of the Department of Scientific and Industrial Research stands as a conspicuous example. But they have had no successors of equal influence. The backwardness of many parts of our national organisation—agriculture a conspicuous example—is the consequence.

The members of our Governments being drawn from the two Houses of Parliament, the qualities of the Parliament condition those of the Government. There is no doubt that our legislature is weak on the scientific side, so that our Governments are weak as well. All the more reason that the small number of members of both Houses who are interested should come together, and be active in making their influence felt. Hence the establishment of the Parliamentary and Scientific Committee. Wisely the Committee has linked itself, through a combined membership, with the organisations representing the great industries which are based upon applied science.

The Work of the Parliamentary and Scientific Committee

The work of the Committee has been threefold. First, it considers a great variety of specific points referred to it, and presents to the proper authorities constructive proposals. Papers are prepared and circulated with the comments of persons entitled to speak. Representations are made to the right section of the vast organisation that has been set up by the Government, under the general direction of the Scientific Advisory Committee of the War Cabinet, of which Lord Hankey is the efficient chairman.

Secondly, the Committee has a function of criticism. That the help of men of science was insufficiently used in the early stages of the war was soon made manifest and is now generally admitted. That mistakes should still be committed and omissions still occur is only to be expected. And there is always a danger that, when scientists are brought into Government Departments to help the bureaucracy to become science-minded, it may be the scientists who, quite soon, become bureaucratic-minded. The Parliamentary members of the Committee hear of defects in the system from their constituents or others, and the industrial members from their organisations. Steps are taken to bring them to notice and to secure redress.

Thirdly, the interests of the scientific workers themselves, of every grade, have to be protected. The Committee is a link between them all, and can play a useful part here. There will arise, when the war ends, particular questions relating to scientists now in the Services or employed in war work; the Institute of Physics has lately drawn attention to this. The Committee might find intervention desirable in these matters also.

I would venture to submit that a fourth department might be added. The Committee might, I suggest, devote more attention than hitherto to the general question of post-war organisation and reconstruction. Winning the war must take priority over all else; every other matter must take second place. But, in that second place, planning to meet the situations that will arise immediately the war ends, and in the years that will follow, should command attention now. Unless these matters are considered, well in advance, and unless policy has been settled and action prepared, there will come, at the end of the war, a period of indecision and confusion. If the great problems of employment, which are likely immediately to arise, are not handled swiftly and successfully, and effect given to the national resolve to build a better Britain, there will surely be throughout the country a sense of frustration; a feeling of resentment and anger, which might even boil up to the point of upheaval.

Scientists have a part to play in the preparation of post-war conditions. On the physical side of Reconstruction, the new science of Town and Country Planning must take a large share in the direction; and much more research in building methods and materials is known to be necessary. In another sphere, there will be need to re-establish international contacts between the academies and other organisations. Professor A. V. Hill, in a useful paper read at the annual general meeting of the Parliamentary and Scientific Committee on January 28th, 1941 (which was published in *Nature* of March 1st, and reprinted as a pamphlet), dealt with this, among many other matters, and outlined various steps that should be taken. I might mention also a proposal, to which I have referred on other occasions, made by the late Professor Graham Wallas to a Royal Commission of which he had been a member: namely, that our official representation abroad should include the appointment of scientific observers. The principal embassies have their Military, Naval and Air attachés, and Commercial and Press attachés as well. If their staffs also included qualified men of science, to keep a constant watch on inventions, processes and systems of organisation in the countries where they were stationed, and to report on them to the suitable authorities at home, useful results would be likely to follow. The Foreign Secretary, Mr. Eden, in a speech not long ago, expressed the hope "that in peace-time diplomacy might be the servant of science." Here is one method of service. [The recent appointment of Professor Scott Watson as Agricultural Attaché in Washington and Agricultural Adviser to the High Commissioner for the United Kingdom in Canada affords welcome practical evidence of governmental acceptance of the value of the procedure suggested.—*Editor.*]

I would revert, in conclusion, to the question with which I began—how far men of science should concern themselves with politics.

Sir Henry Dale, in his Presidential address to the Royal Society last December, emphasised certain dangers. He spoke as follows: "There was one direction in which he saw some reason to fear for the freedom of science. If science should become entangled in controversial politics, through the over-eagerness of its advocates to invoke the sanction of science or to claim its potentialities in support of any special political doctrine, the threat to its freedom might become a real danger. If science were allowed to be used as a weapon of political pressure it would be impossible to protect science from the pressure of sectional politics. If that should happen the dangers were beyond dispute—the danger, for example, that fundamental researches having no immediate practical appeal would be allowed to fall into arrears through relative neglect; or the danger that the rigid standards of true science would be replaced by allowing the convenience of results for policy or for propaganda to enter into the assessment of their validity as evidence."

The publication of that address was followed by an interesting correspondence in *The Times*. In the course of it, Sir Richard Gregory expressed the hope, in which I would concur, that Sir Henry Dale's fear of entanglement in controversial politics would "not present a bogy to the advancement of the social sciences"; and added that if their contribution to social problems "is to intrude into the field of politics, many men of science are prepared to-day to accept this implication."

Professor A. V. Hill wrote: "Let us confidently apply the results of science to human betterment; but not allow our desire for betterment to upset our scientific conclusions or bias our scientific judgments. Above all, let scientists avoid exploiting the public prestige of science, of which they are trustees, for advertising their private political views."

The Times itself, in a leading article, declared of the scientist: "In himself, he may, or must, be both politician and man of science; but the man of science in him must not know or care what the politician thinks"; and summed up the whole matter by saying, "Science can be and has been brought into politics without politics creeping into science." That pithy sentence seems to me fitly to speak the last word on the matter.

LEGAL NOTES

Schedule of Reserved Occupations: No Statutory Force.—The Court of Appeal—the Master of the Rolls, Lord Justice MacKinnon, and Lord Justice Goddard—has dismissed an interlocutory appeal against an order, in Chambers, of Mr. Justice Croom-Johnson, refusing to grant an interim injunction at the instance of the plaintiff against the Minister of Labour and National Service to restrain the Minister from causing or permitting an enlistment notice under the Armed Forces Act to be enforced against him (the plaintiff) on the ground, as the plaintiff said, that such notice was invalid because the terms of the Schedule of Reserved Occupations, and an explanatory memorandum in connection therewith, had not been complied with.

The Court, in giving judgment, said that the plaintiff's main argument was based on the view that the Schedule of Reserved Occupations, with the explanatory memorandum, had in some way or another a statutory force with the result that everything in them must be complied with by the Minister and that if that were not done the enlistment notice would be illegal. In point of law the documents in question were nothing more than a statement by the Minister of the principles on which he proposed to proceed with regard to the calling up of men in reserved occupations. If those documents had not been published inconvenience or hardship to members of the public might have been occasioned. It was a mistake to suppose that they had any legal force or imposed on the Minister or on anybody else any statutory obligation. There was in the case before the Court no statute or regulation which entitled the plaintiff to say that he had any right to disregard the enlistment notice which he had received.

* * * * *

GENETICAL FACTORS IN PIG BREEDING

Dr. M. Olbrycht, who won the N.P.B.A. Paget Memorial Prize and Silver Medal last year for his treatise on colour variation in Wessex Saddleback pigs, is now continuing his studies with Essex pigs. At the same time he is enquiring into the differences in conformation compared with the other saddled pig. One question to which Dr. Olbrycht is seeking an answer is the value of the colour in pedigree breeding.

Dr. Olbrycht is a well-known Polish research worker and a victim of the German invasion; he was unable to return home from the Edinburgh Genetical Conference in the autumn of 1939, and since then he has had little news of the fate of his own centre.—*Farmer and Stock-breeder.*

* * * * *

SHORTHORN SOCIETY BULL REGISTER QUALIFICATIONS

The Shorthorn Society has decided to tighten up the butterfat qualifications for its Register of Qualified Bulls. At a meeting of the Council of the Society it was decided to raise the minimum qualifying percentage for the dams from 3·3 to 3·75. This new provision will operate in respect of lactation period records started on or after October 1st, 1941. The Council also decided that in the case of bulls born on or after January 1st next, both the dam and the sire's dam must be qualified. The entries of bulls whose sires were born before January 1st, 1938, will continue to be accepted for the butterfat section if their dams only have qualified.

* * * * *

Exports of livestock from Eire were valued at £8,119,444 in 1941, compared with £14,484,569 in 1940 and £14,256,785 in 1939. The sharp decline last year was largely due to the incidence of foot-and-mouth disease in Eire; it was compensated for in some measure by the export trade in dressed meat instead of live cattle.

"Whether, under present conditions Eire can maintain its heavy livestock population is a problem which remains to be determined," comments *The Farmer and Stock-breeder*, which continues: "At the present time fears are being expressed for the future of the dairying industry, which is coming very slowly out of its winter 'low,' and considerable pressure is being exerted to raise the prices of butter and milk with the object of aiding this branch of farming. Creamery work is also said to be non-paying."

* * * * *

The Colonial Office announces that the Court of Governors of the London School of Economics and Political Science have granted to Dr. Frederic C. Banham, Sir Ernest Cassel, Reader in Commerce in the University of London, leave to accept the post of Economic Adviser to the Comptroller for Development and Welfare in the West Indies for a period of from two to three years, or for the duration of the war, whichever is the shorter.

INTRAVENOUS ANAESTHESIA IN LARGE ANIMALS*

The advantage of intravenous over inhalation anaesthesia is that it may be administered by the surgeon before beginning the operation, and he may then proceed with little or no further attention to it. Since most veterinarians must operate without the assistance of skilled anaesthetists, this advantage is an important one.

In the adult horse chloral hydrate is the most satisfactory; it is reasonably cheap, stable, easily prepared and quite safe. A 12 per cent. solution has proved to be the most convenient. The injection must be strictly intravenous, as chloral hydrate is escharotic. The instruments necessary are a 14-gauge hypodermic needle 1½ in. long, a long 18-gauge needle with a closed end and two small side openings (a tomcat catheter), and a rubber injection outfit. For operations of short duration, the casting harness is applied and an area over the jugular vein and about two-thirds of the way up the neck is shaved and painted with tincture of iodine. The cork is removed from the bottle of chloral hydrate and the injection outfit attached. The jugular vein is distended with the left thumb and the 14-gauge needle inserted into the vein with a quick thrust. When blood flows freely through this needle, the long needle is inserted through it and along the jugular vein until its hub contacts the hub of the short needle. The bottle of chloral hydrate is inverted until some solution runs from the end of the injection outfit to free it of air; the end is then attached to the hub of the long needle. The solution should not be injected too rapidly as shock may be produced. The speed of injection can be slowed by finger pressure on the small tube that admits air to the bottle. When the horse has received enough of the solution, he weaves from side to side and goes down. Just before he falls, the needle may be removed from the vein. When the casting harness is tightened, the horse is ready for a minor operation.

For long and painful operations, a basal narcotic of chloral hydrate *via* stomach tube is given about 30 minutes before operating. For this, about one-half ounce of chloral to each 500 pounds of body weight is dissolved in lukewarm water. As the horse becomes quiet, he is cast and secured, and chloral hydrate is injected intravenously as described above. When nystagmus has practically disappeared and the corneal reflex is still present but much weakened, a stage of surgical anaesthesia which will last 30 minutes or longer has been reached. Complete obliteration of the corneal reflex indicates profound anaesthesia, a state close to the borderline of cardiac and respiratory failure. A 1,500 pound horse will usually require about 750 c.c. of solution (1½ ounces of chloral hydrate by stomach tube and three ounces intravenously). More than this approaches the danger line.

Recovery is slower than following chloroform anaesthesia, and the heat-regulating mechanism is seriously depressed. In cold weather the horse should be blanketed for several hours after the operation; in hot weather, heat prostration must be watched for. The pharyngeal reflex is depressed for some time, so feed and water should be withheld for four or five hours, or mechanical pneumonia may follow.

Nembutal has not been satisfactory for the adult horse, but it is excellent for colts up to six or seven months of age and especially for foals a few days to a few weeks old. It is injected slowly with a syringe. The average dose is 25 c.c., although for small foals as little as 5 c.c. may be sufficient, and larger colts and ponies may require as much as 50 c.c.

In cows of the smaller breeds and in calves and heifers of the larger breeds up to 900 or 1,000 pounds in weight, nembutal is satisfactory, except that in some cases the expense may be a disadvantage. The amount required for a medium-sized Jersey is from 75 to 125 c.c. The drug is injected into the jugular vein in the same manner as in the colt, except that it is usually preferable to cast the cow first. Disappearance of the corneal reflex is used as the indication of surgical anaesthesia. Recovery takes longer than with chloral hydrate and the same precautions regarding blanketing in cold weather should be observed.

In larger cows and where the expense would make nembutal impractical, chloral hydrate may be used intravenously, employing the same general technique as for the horse. Large bulls of any breed and heavy beef cows are so susceptible to the toxic effects of any general anaesthetic that its use should not be attempted.

In large swine, 10 to 20 c.c. of nembutal injected intravenously into the marginal ear vein is quite successful. A glass syringe with a 20-gauge needle one inch long is used.

Chloral may produce either cardiac or respiratory failure or both; nembutal may depress the respiration until failure occurs. If toxic symptoms appear, removal of all restraint

* Fowler, Geo. R. (1941.) Intravenous anaesthesia in large animals. *J.A.V.M.A.* **98**. pp. 399-402.

and cessation of surgical procedures are in order. Caffeine may be used as a stimulant.—Abstr. *Vet. Med.* (1941.) **36**. 624-625.

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NOMENCLATURE OF *CL. WELCHII* "TOXINS" TYPE *A*

"The investigation of the toxins produced by *Cl. welchii* type *A* (classic gas gangrene of man) has led to the recognition of the complex nature of the soluble substances recovered from filtrates of cultures of this organism," states *Nature* in its issue of January 10th, and continues: "The attempt to analyse these substances into their component elements has led to certain unfortunate confusions in the nomenclature, as pointed out by Llewellyn-Smith [1].

"In view of the difficulties presented to research workers by this state of affairs, an informal meeting convened by Dr. M. Stephenson was held, under the chairmanship of Prof. T. Dalling of the Institute of Animal Pathology, Cambridge, at the Biochemical Laboratory in Cambridge on April 5th, 1941, at which workers actively engaged in research in this field and those responsible for the production of antisera were present by invitation.

"After a full discussion it was decided to adopt the following nomenclature as the basis of future publication.

(1) Among the antigenic substances found in filtrates the main toxic element is characterised by the following biological properties:

(*a*) It is lethal for mice when administered by intravenous injection.

(*b*) It produces a characteristic necrotic reaction on intradermal injection into guinea-pigs.

(*c*) It is haemolytic *in vitro* for sheep red cells, the haemolysin being oxygen-stable and requiring the presence of calcium ions for the full development of its action [2].

(*d*) It reacts specifically with normal human serum [3] and with egg-yolk solution to give a characteristic turbidity [2].

This reaction also requires the presence of calcium ions and is probably due to the action of a lecithinase which splits phosphocholine from lecithin [4].

These various reactions appear to be due to the action of one substance designated as the *alpha toxin* and they can be neutralised by alpha antitoxin.

The *alpha* toxin has long been recognised as the main element in the pathogenic action of *Cl. welchii* type *A* [5].

(2) A second haemolysin has been recognised in *Cl. welchii* filtrates which has properties distinct from those of the *alpha* toxin:

(*a*) It exhibits a slight but irregular action when administered intravenously to mice, owing to the presence of natural antitoxin in this and other experimental animals.

(*b*) It produces a haemorrhagic reaction, but it is not necrotic in action on intradermal injection into guinea-pigs.

(*c*) It is haemolytic for sheep red cells *in vitro*; the haemolysin is reversibly oxidisable, the haemolytic activity declining with the ageing of filtrates; the haemolysis is independent of the action of calcium ions.

(*d*) It does not give a reaction with human serum or egg yolk solution.

(*e*) It resembles closely streptolysin O.

(*f*) The reactions produced by this second haemolysin are neutralised by high titre antihaemolysin O as well as by the homologous antiserum.

It was agreed that this second haemolysin should be designated as *theta haemolysin*, and that it should be clearly recognised as being distinct from *alpha* toxin of *Cl. welchii*.

"The first mention of this type of haemolysis is made by Neill' but no special nomenclature was adopted. Prigge erroneously called this haemolysin *alpha'* and this mistake was repeated in the League of Nations Bulletin of the Health Organisation (**8**, 797; 1939).

"The letter theta was first used as a designation for this haemolysin in the literature by Macfarlane, Oakley and Anderson[2], and its properties have been clearly defined by Todd [8].

"The use of zeta [7] for what is obviously the alpha toxin is therefore discarded according to the ordinary usages of nomenclature.

"No assumption is made that these two elements are the only 'toxins' present in filtrates from all strains of *Cl. welchii*, type *A*."

(1) Nature. (1941.) 147. 87.
(2) Macfarlane, Oakley and Anderson. (1941.) *J. Path and Bact.* 52. 99. van Heyningen (1941), about to be published.
(3) Nagler. (1939.) *Brit. J. Exp.* 20. 473.
(4) Macfarlane and Knight. (1941.) *Biochem. J.* 35. 884.
(5) Glenny, Barr, Llewellyn-Jones, Dalling and Ross. (1933.) *J. Path and Bact.* 37. 53.
(6) *J. Exp. Med.* (1926.) 44. 199, 215, 217.
(7) *Z. Immunitätsforsch.* (1937.) 91. 457.
(8) *Brit. J. Exp. Path.* (1941.) 22. 172.

H.M. STATIONERY OFFICE PUBLICATIONS

The undermentioned have been published recently. Copies can be purchased through any bookseller, or directly from H.M. Stationery Office.

	Price net s. d.	Post free s. d.
Agriculture and Fisheries, Ministry of:		
Leaflets, Advisory. 310. Liver Rot in Sheep and Cattle	0 1	0 2
Dozen	0 9	0 11
312. Common Worms of the Pig	0 1	0 2
Dozen	0 9	0 11
Statutory Rules and Orders, 1942:		
709. Shortage of Drugs. Scarce Substances Order, May 12th	0 1	0 2
Medical Research Council:		
War Medicine, Bulletin of. Vol. II. No. 5. May, 1942. (45-10-2-5)	2 6	2 9
Home Security, Ministry of:		
Chart of War Gases. War Gases, Their Nature, Effects and First Aid Treatment. (Pocket Edition.)	0 1	0 2
25	1 6	1 10

CORRESPONDENCE

Letters to the Editor should reach the Office not later than by the first post on Monday morning for insertion in following Saturday's issue.
The views expressed in letters addressed to the Editor represent the personal view of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

* * * * *

"TO WHOM HONOUR IS DUE"

Sir,—May one resuscitate the above title which formed that of a communication to these columns on February 28th last? I have deferred comment, pending the receipt of the new Register, in case the regulations governing the award which this correspondent so strongly urged had been revised.

If he will turn to page 42, paragraph 105a, in the Register he will learn why, despite his zeal, it is not possible for the Fellows and Members of Council to fall in with his suggestion.

Honour is always due to those who by research discover new things. Credit is the perquisite of those who endeavour to make these more widely known. Such is the case in the present instance. This should suffice.

Yours faithfully,
J. F. D. Tutt.

Winchester.
May 22nd, 1942.

DISEASES OF ANIMALS ACTS, 1894 TO 1937, AND AGRICULTURE ACT, 1937 (PART IV)

Summary of Returns of Confirmed Outbreaks of Scheduled (Notifiable) Diseases

Period	Anthrax	Foot-and-mouth	Parasitic Mange*	Sheep Scab	Swine Fever
April 16th to 30th, 1942	19	—	—	7	18
Corresponding period in—					
1941 ...	21	14	—	15	40
1940 ...	31	1	—	4	170
1939 ...	34	—	4	2	87
Total Jan. 1st to Apr. 30, 1942	114	11	26	105	141
Corresponding period in—					
1941 ...	184	209	7	114	639
1940 ...	214	18	11	105	1,296
1939 ...	338	29	25	142	492

Note.—The figures for the current year are approximate only.
* Excluding outbreaks in Army Horses.

Tuberculosis (Attested Herds) Schemes

The number of Attested Herds, *i.e.*, herds officially certified as free from Tuberculosis as at 30th April, 1942, was as follows:—

England	Wales	Scotland	Total (Great Britain)
3,895	9,064	3,362	16,321

NOTICES

ORIGINAL Articles are accepted only on the understanding that the "Veterinary Record" has priority of publication.

IT must be understood that the acceptance by the National Veterinary Medical Association of an advertisement for either the professional or commercial ("display") section does not imply a recommendation and that no responsibility is accepted with regard to the accuracy of any claims made or other statements therein contained.

"VETERINARY RECORD" AND CHANGES OF ADDRESS

READERS are asked to send to 10, Bore Street, Lichfield, Staffordshire, notification of any change in their address by MONDAY MORNING if they wish the following Saturday's issue of "The Veterinary Record" to be sent to the new address.

The publication of this notice is prompted by the number of readers who notify change of address too late for any alteration to be effected before the following week.

Scottish Metropolitan Division, N.V.M.A.

A MEETING of the Division will be held in the Royal Hotel, Union Street, Dundee, on Wednesday, June 10th, at 2 p.m., with the President, Sir Arthur Olver, in the chair.

AGENDA

Routine.

Short Papers :—

(1) "The use of Nerve Blocking in General Practice," by J. S. A. Spreull, PH.D., M.R.C.V.S., Dundee.

(2) "Some Observations on Common Methods of Castration," by J. F. Watson, M.R.C.V.S., Milnathort.

(3) "The Local Application of Sulphonamides," by A. J. McLennan, B.SC., M.R.C.V.S., Edinburgh.

Any other business.

ALEX. ROBERTSON, *Hon. Secretary.*

North Wales Division, N.V.M.A.

A MEETING of the North Wales Division will be held at the Swiss Café, Llandudno, on Friday, June 19th, at 2 p.m. The President, Mr. W. T. Rowlands, will occupy the chair.

AGENDA

Routine.
Correspondence.
Nominations and Elections.
Address : "Sub-clinical Helminthiasis of Farm Animals," by Dr. E. L. Taylor, M.R.C.V.S., D.V.H.
Discussion.
Any other business.

H. E. HARBOUR, *Hon. Secretary.*

PROFESSIONAL ADVERTISEMENTS

These will be received at 36, GORDON SQUARE, W.C.1 up to TUESDAY MORNING

For Members of the Association

First insertion: 1/- for each six words or less, minimum 18 words (3/-). *Repeat insertion*: 6d. for each six words or less, minimum 18 words (1/6).

Public Bodies, Institutions and Non-Members

First insertion: 2/6 for each six words or less, minimum 18 words (7/6). *Repeat insertions*: 1/3 for each six words or less, minimum 18 words (3/9).

Veterinary Students

First insertion: 8d. for each six words, minimum 18 words (2/-). *Repeat insertions*: 4d. for each six words, minimum 18 words (1/-).

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1/- irrespective of number of insertions. *These Advertisements will not be inserted unless prepaid.*

Replies to Box Numbers should be addressed to the appropriate Box at the Office. Telegrams addressed to Box Numbers will be forwarded by post unless accompanied by a "reply paid" form.

APPOINTMENTS VACANT

APPLICANTS for posts are requested not to enclose original testimonials when replying to advertisements. Copies answer the same purpose and cause no inconvenience if mislaid.

WANTED, young Assistant with view to partnership and succession. Must have good knowledge of sterility and be able to operate on small animals. Capital not essential.—Apply Box 513.

WANTED, capable Assistant. Apply immediately with references to Box 511.

WANTED, capable Locum for mixed practice, mainly agricultural. June 15th, for about six weeks. References and full particulars.—Box 507.

APPOINTMENTS REQUIRED

1941 Graduate, 25, motorist, good experience in livestock management, horses especially, seeks Assistantship or extended Locum with practitioner in mixed country practice.—Box 512.

JULY, 1941, Graduate, free immediately for permanent or temporary employment; sound knowledge of agricultural practice and Ministry procedure. Good academic record. Own car available. Age 23; height 5 ft. 9 in. References and other particulars from Box 514.

MEMBER, 10 years' experience agricultural and dairy practice, desires post with view to permanency. Thoroughly competent and practical: Castration, obstetrics, sterility, etc. Own car.—Box 516.

PRACTICES REQUIRED

MEMBER desires to purchase agricultural practice, preferably the Midlands, or Partnership with early succession.—Box 498.

MEMBER desires to purchase agricultural practice. Would consider Partnership or Assistantship with view to Partnership. Comprehensive experience in all branches.—Box 510.

WANTED, Agricultural or Mixed Practice, Eastern Counties preferably. Capital available.—Box 519.

PRACTICES FOR SALE

MIXED Practice for sale, established 1875, agricultural district, South England; suit energetic man. Particulars on applying to Box 517.

FOR SALE, owing to death of owner, nucleus of small-animal practice in London. For full particulars write Box 510.

PARTNERSHIP

PARTNERSHIP wanted, good country practice, or would consider purchase of sound business.—Box 515.

MISCELLANEOUS

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